Revised June 21, 2010

Advanced Workshop in Regulation and Competition

23rd Annual Western Conference

Hyatt Regency, in Monterey, California, on June 23-25, 2010

The Conference features some of the latest developments in the network industries, especially energy, including:

- Deregulation
- Market Structure
- Policy and Regulatory Issues
- Environmental Policy and GHG
- Telecommunications and Water
- Pricing and Demand Response
- Capacity and Reliability

Who should attend:

- Industry Economists, Consultants and Attorneys
- Marketing and Regulatory Managers
- Regulatory Commission Staff

Featured Speaker: William E. Kovacic, Commissioner – FTC
Dinner Speaker: John A. Bohn, Commissioner, CPUC

CENTER FOR RESEARCH IN REGULATED INDUSTRIES

RUTGERS

CENTER FOR RESEARCH IN REGULATED INDUSTRIES

The ***Center for Research in Regulated Industries***, located at Rutgers University, aims to further study of regulation in economics, finance, and institutions. Its publications, seminars, workshop, and courses make available the latest advances to academics, managers, and regulatory commission staff. The Center has over thirty years of experience providing research, instruction, conferences, courses, seminars, and workshops in economics of network industries. The Center's *Journal of Regulatory Economics* is an international scholarly bi-monthly publication intended to provide a forum for the highest quality research in regulatory economics. Other research from the Center's programs has been published in the book series *Topics in Regulatory Economics and Policy*.

crri@rbs.rutgers.edu
www.crri.rutgers.edu

Rutgers Business School □ 1 Washington Park, Room 1104 □ Newark, NJ 07102-1897

973-353-5761 □ 973-353-1348 (fax)

WEDNESDAY, JUNE 23, 2010

2:00 - 4:00 Registration *Regency Foyer North*

4:00 - 6:00 Welcome to Conference: Michael A. Crew *Regency 4-5*

Ahmad Faruqui, S. Sergici & L. Akaba: Does Dynamic Pricing Work in a Moderate Climate? Econometric Analysis of Experimental Data from New England

Cliff Rochlin: A Fuel Without a Voice

William Kovacic: Regulation by Independent Commission: College or Hierarchy?

6:00 - 7:00 Cocktail Hour *Big Sur 1-3*

7:00 – 9:00 Dinner & Keynote Speech: **John A. Bohn**, Commissioner, CPUC *Cypress 1-3*

9:00 – 10:00 Reception *Big Sur 1-3*

THURSDAY, JUNE 24, 2010

8:00 - 9:40 ***Concurrent Sessions***

WIND *Spyglass 1-2*

Chair: Kevin O'Beirne

Discussants: Fred Curry & Richard McCann

Robert Earle: The Portfolio Capacity Value of Wind, Solar, Energy, Efficiency, and Demand Response

Guy Holburn, K. Lui & C. Morand: Policy Risk and Private Investment in Ontario's Wind Power Sector

Paul Nelson: Modeling Wind & Load for Cost and Reliability Studies

NETWORKS *Big Sur 1-2*

Chair: Menahem Spiegel

Discussants: John W. Mayo & Timothy J. Tardiff

Victor Glass: A Market-based Assessment of Universal Service Reform Requirements

David Sappington & Ying Tang: Sabotaging Innovation

Gregory Duncan: A General Approach to Determining Right of Way Fees in Thin Markets

9:40 – 10:00 Coffee Break *Big Sur/Cypress Foyer*

10:00 - 11:40 ***Concurrent Sessions***

STORAGE *Spyglass 1-2*

Chair: Dennis Keane

Discussants: Chaim Elata & Gary Stern

Timothy Mount: Integrating Renewables into Electricity Markets: The Need for Smart Regulation

Ramteen Sioshansi: Using Storage to Increase the Market Value of Wind Generation

Nicole Taheri & R. Entriken: A Feasibility Analysis of Limited Energy Storage for Regulation Service

RISK MANAGEMENT *Big Sur 1-2*

Chair: Joanne C. Wang

Discussants: Alan Finder & Raymond Johnson

Art Altman: Electricity-Price Modeling: Gaps & Disruptions

Robert Entriken: Towards a Risk Analysis Framework for Extreme Weather Impacts on Electric Power Systems

Frank J. Rahn: Risk Margins and Risk Measures: Establishing Risk Informed Regulations and Performance Goals

11:40 - 1:00 Lunch Break

1:00 - 2:30 ***Concurrent Sessions***

RENEWABLE INTEGRATION *Spyglass 1-2*

Chair: Joseph Abhulimen

Discussants: Matthew Barmack & Robin Walther

Taiyou Yong: Developing Stochastic Optimal Power Flow Tool for Large Scale Power Systems

Udi Helman: Operational and Market Simulation of Alternative 33% RPS Portfolios in California

Carl Linvill, R. McCann & J. Candalaria: Modeling Approach and Stakeholder Process: Earning Consent for Aggressive GHG and Renewable Energy Goals in the West

STRATEGIES *Big Sur 1-2*

Chair: Sandra Bennett

Discussants: Phillip McLeod & Amparo Nieto

Farrokh Rahimi: Bringing Prices to Devices under Smart Grid: Challenges and Opportunities

Tatyana Kramskaya (**Presented by David Hunger**)**:** Elimination of Barrier to Participation by Demand Resources in Organized Wholesale Electric Markets

David Yates & M. Pocernich (Presented by R. Aslin): Stationarity is Dead – A practical solution for utility scale planning models

2:30 - 4:00 ***Concurrent Sessions***

ELECTRIC VEHICLES *Spyglass 1-2*

Chair: Julie Kelly

Discussants: Rick Codina & Gary Stern

Marcus Alexander: The Integration of Plug-in Hybrid Electric Vehicles (PHEVs) for Wind Balance

Robert Levin: Electric Vehicles: A Ratepayer Perspective

Eric Cutter: Beyond Emissions: The Utility Shareholder and Ratepayer Benefits of Plug-in Hybrid and Electric Vehicles

MARKET DESIGN *Big Sur 1-2*

Chair: Philippe Auclair

Discussants: Scott Harvey & Jeffrey McDonald

Jeffrey Nelson (Presented by Willy Wang): California's New Electricity Market: Overview of First Year of Performance and Recommendations Moving Forward

Kory Hedman, S. Oren & R. O'Neill: Optimal Transmission Switching: Economic Efficiency and Market Implications

Kevin Woodruff: Economists Play With Blocks: The Challenges of Designing Markets for the Electric Industry

FRIDAY, JUNE 25, 2010

8:45 - 10:40 ***Concurrent Sessions***

RATE PARADOXES *Spyglass 1-2*

Chair: Rami Kahlon
Discussants: Matthew Arenchild & Todd Cameron

Carl Danner: Rational Expectations and the Conservation-Oriented Pricing of Utility Services

Stephen St Marie: Effects of High Tiered Rates on the Financial Stability of Regulated Utilities and Necessary Regulatory Response, with Application to Water Utilities

Ron Knecht: What Events and Policy Have Done to the Cost of Capital – and What They May Do in the Future

CHP/GHG *Big Sur 1-2*

Chair: David E. Hunger
Discussants: Matthew Barmack & Kevin Woodruff

Michael Colvin: Combined Heat and Power in California

Carl Silsbee: Cogeneration Facility Greenhouse Gas Reduction Potential

Catherine Elder: A Closer Look at the Connection between Natural Gas Demand and CO2 Allowance Prices

10:40 – 11:00 Coffee Break ***Big Sur/Cypress Foyer***

11:00 - 12:55 ***Concurrent Sessions***

SMART GRID *Spyglass 1-2*

Chair: Stephen Keehn
Discussants: Carl Linvill & Robin Walther

Andrew Campbell: Does a Smart Grid Require Smarter Regulation?

Eric Woychik: Policy Vision for the Smart Grid: Performance Metrics & Incentives for Optimal Investment

Robert Robinson: Smart Grid – A Transaction Cost Economics Review of Alternative Market Structures

GHG CONTROL *Big Sur 1-2*

Chair: Menahem Spiegel
Discussants: Michael S. Alexander & Nguyen Quan

Scott Harvey & Susan Pope: Evaluation of Midwest ISO Injection/Withdrawal Transmission Cost Allocation Design

Frank Harris: On the Right to Submit Emissions Offsets When Regulators Impose Binding Quantitative Limits

Michael Stadler, C. Marnay, J. Lai, G. Cardoso, O. Mégel & A. Siddiqui: Influence of CO2 Pricing on Distributed Energy Resources in California's Commercial Buildings

SPEAKERS DISCUSSANTS & CHAIRS

Joseph Abhulimen, Program Supervisor, California Public Utilities Commission
Marcus Alexander, Manager, Vehicle Systems Analysis, EPRI
Michael S. Alexander, Southern California Edison
Art Altman, Program Manager – Assest & Risk Management, EPRI
Matthew Arenchild, Director, Navigant Consulting, Inc.
Richard Aslin, Manager - Economics, Forecasting and Rate Data Analysis, PG&E
Philippe Auclair, Director, Asset Management, NRG West
Matthew Barmack, Director, Market and Regulatory Analysis, Calpine Corporation
Sandra Bennett, Vice President, Regulatory & Finance, Southwestern Electric Power Company
John A. Bohn, Commissioner CPUC
Todd Cameron, Economist, Southern California Edison
Andrew Campbell, Senior Energy Advisor to Commissioner, CPUC
Rick Codina, Pricing Advisor, Sacramento Municipal Utility District
Michael Colvin, Policy Analyst, Policy and Planning Division, CPUC
Michael A. Crew, CRRI Professor of Regulatory Economics, Rutgers University and Director - CRRI
Fred Curry, Regulatory Consultant
Eric Cutter, Energy and Enviornmental Economics
Carl Danner, Director, LECG LLC
Gregory M. Duncan, Principal, The Brattle Group & University of California Berkeley
Robert L. Earle, Vice President, Analysis Group
Chaim Elata, Professor Emeritus, Ben Gurion University
Catherine Elder, Senior Associate, Aspen Environmental Group
Robert Entriken, Senior Manager, Policy Analysis, EPRI
Ahmad Faruqui, Principal, The Brattle Group
Alan Finder, Director, KPMG LLP
Victor Glass, Director of Demand Forecasting and Rate Development, National Exchange Carrier Association, Inc.
Frank Harris, Manager – Global Climate Policy, Southern California Edison
Scott Harvey, Director, LECG
Kory Hedman, Ph.D Candidate, University of California Berkley
Udi Helman, Principal, Markets and Infrastructure Division, California ISO
Guy Holburn, Associate Professor, Richard Ivey School of Business, University of Western Ontario
David E. Hunger, Senior Economist, Federal Energy Regulatory Commission
Raymond Johnson, Manager, Portfolio Development, Southern California Edison
Dennis Keane, Manager, Electric Rates, Pacific Gas & Electric
Stephen Keehn, Regulatory Policy Manager**,** Sempra Utilities
Julie Kelly, Research Staff Member, Institute for Defense Analyses
Ron Knecht, Economist, Pubilic Utilitis Commission of Nevada
William E. Kovacic, Commissioner, U.S. Federal Trade Commission
Robert Levin, Division of Ratepayer Advocates, CPUC
Carl B. Linvill, Director Energy Planning and Analysis Division, Aspen Environmental Group
John W. Mayo, Professor of Ecomomics, Business & Public Policy, McDonough School of Business
Richard McCann, Director Energy Planning and Analysis Division, Aspen Environmental Group
Jeffrey McDonald, Manager, Market Monitoring & Reporting, California Independent System Operator
Phillip McLeod, Principal, Finance Scholars Group
Timothy D. Mount, Professor, Cornell University
Paul Nelson, Senior Regulatory Economist, Market Strategy & Resource Planning, Southern California Edison
Amparo Nieto, Senior Consultant, NERA Los Angeles
Kevin O'Beirne, Regulatory Case Manager, San Diego Gas & Electric
Shmuel Oren, Professor**,** University of California at Berkley
Nguyen Quan, Manager – Regulatory Affairs, Golden State Water Company
Susan Pope, Principal, LECG
Farrokh Rahimi, Vice President, Market Design and Consulting, Open Access Technology International, Inc.
Frank Rahn, Electric Power Research Institute
Robert, Vice President, Charles River Associates
Cliff Rochlin, Market Consultant, Southern California Gas Company
David Sappington, University of Florida
Carl Silsbee, Manager of Regulatory Economics, Southern California Edison
Ramteen Sioshansi, Assistant Professor, Integrated Systems Engineering Department, The Ohio State University
Gary Stern, Director of Marketing Strategies & Resource Planning, Southern California Edison
Stephen St Marie, Policy and Planning Advisor and Chief of Staff to Commissioner, California Public Utilities Commission
Menahem Spiegel, Associate Professor, Finance & Economics & Associate Director, CRRI
Michael Stadler, Staff Scientist, Ernest Orlando Lawrence Berkeley National Laboratory and USA and Center for Energy and Innovative Technologies
Nicole Taheri, Stanford University
Timothy J. Tardiff, Principal, Advanced Analytical Consulting Group
Robin Walther, Professional Affiliate, Finance Scholars Group
Joanne C. Wang, Director, Risk Management, Sempra Utilities
Willy Wang, Southern California Edison
Kevin Woodruff, Principal, Woodruff Expert Services
Eric Woychik, Director, Energy Strategy Practice, Black & Veatch Corporation
David Yates, NCAR
Taiyou, Yong, Elecric Power Research Institute

23rd ANNUAL WESTERN CONFERENCE

ORGANIZING COMMITTEE

Matthew Arenchild (Navigant Consulting, Inc.)
Michael A. Crew (Rutgers University)
Fred Curry (Regulatory Consultant)
Carl Danner (Wilk & Associates/LECG)
Robert Earle (Analysis Group)
Robert Entriken (EPRI)
Ahmad Faruqui (Brattle Group)
Rami Kahlon (California Public Utilities Commission)
Dennis Keane (Pacific Gas & Electric)
Carl B. Linvill (Aspen Environmental Group)
Cliff Rochlin (Southern California Gas)
Carl Silsbee (Southern California Edison)
Kevin D. Woodruff (Woodruff Expert Services)

CONTACTING CRRI

Home Page: www.crri.rutgers.edu

Address: Center for Research in Regulated Industries
Rutgers Business School, Rutgers University,
1 Washington Park, Room 1104
Newark, NJ 07102-1897

Phone: 973-353-5761
Fax: 973-353-1348
Email: mcrew@business.rutgers.edu (Michael Crew)
crri@business.rutgers.edu (Francelis Montes de Oca)

HOTEL RESERVATIONS

Sufficient Rooms are reserved at the Hyatt Regency Monterey Hotel & Spa on Del Monte Golf Course for all of the Conference participants. Participants should register for the conference by returning registration forms to Hyatt Regency. Reservations should be received by **May 25, 2010**. Hotel reservation can be made by phone.

Hyatt Regency Monterey Hotel & Spa on Del Monte Golf Course
1 Old Golf Course Road,
Monterey, California, USA

Hyatt Worldwide Reservations
Tel: (800) 233-1234
Please identify yourself as being held under the group block:
Rutgers University Western Conference.

REGISTRATION INFORMATION

To Register: Please complete and return the form to CRRI. Registrations are accepted by mail, email, fax, and telephone. Please confirm telephone registrations by sending in a completed and signed registration form. The deadline for registrations is May 10, 2010. Registrations received after May 10, 2010 will be admitted on a space available basis.

Volume discount: Second and subsequent applications received in the same envelope, fax, email, or made at the same time by phone will receive a 5% volume discount.

Payment Information: Make checks payable to **"Rutgers University"** and mail to the attention of at the above address. Fees include prescribed learning materials, dinner on Wednesday night, June 23, 2010, all receptions and coffee breaks, but do not include lodging and other meals. The government registration fee is available for government employees.

REGISTRATION FORM: 23rd Annual Western Conference

Name

Title:

Company:

Complete Address:

Telephone: Fax:

Email:

Billing Information:

___ Payment enclosed $1,005 U.S. Dollars (rate is for registrations prior to February 3, 2010).

___ Payment enclosed $1,080 U.S. Dollars (rate after February 3, 2010).

___ Send invoice to participant at above address.

___ Send invoice to_____

___ Credit Card: ___ VISA ___ MC Exp. _____/_____

GOVERNMENT RATE: Government employees may apply for reduced enrollment fees.

___ I would like to apply for the government rate of $540 (rate is for registrations prior to February 3, 21010).

___I would like to apply for the government rate of $575 (rate is for registrations after February 3, 21010).

Card #_____

CANCELLATION POLICY: Until May 10, 2010 cancellation is allowed without penalty and refunds will be allowed in full. After this date, the indicated fee is due in full whether or not the participant actually attends. Substitutions may be made at any time.

Signature of Participant: _____

DOES DYNAMIC PRICING WORK IN A MODERATE CLIMATE?
Econometric Analysis of Experimental Data from New England

Ahmad Faruqui
Sanem Sergici
Lamine Akaba

The Brattle Group
353 Sacramento Street,
Suite 1140 San Francisco, California 94111
Ahmad.tarugui@Brattle.Com

Many experiments with dynamic pricing have been carried out in the US, Canada, the European Union and Australia during the past decade. However, most of them have been located in regions with hot and humid summers.

The summers in New England are mild but even compared to the regional norm, the summer of 2009 was particularly mild. Because of the mild climate, the region has a low saturation of central air conditioning (CAC) systems with only one in three homes having one. These factors would suggest that dynamic pricing would not elicit much of a response from customers in New England. However, the region faces high electric rates and regulators have made demand response measures a priority.

This paper analyzes data from an experiment with dynamic pricing that was carried out in the summer of 2009 by Connecticut Light & Power Company (CL&P), a subsidiary of Northeast Utilities. It was called the Plan-It Wise Energy Pilot (PWEP). The experiment was carried out to see if dynamic pricing can help in lowering future power costs by curtailing peak demands during critical periods or shifting them to other hours.

The PWEP featured three rate designs: critical-peak pricing (CPP), peak-time rebates (PTR) and standard time-of-use (TOU) rates. Low and high values of each rate design were included in PWEP to allow precise estimation of price elasticities. Each variant was designed to be revenue neutral for the class as a whole relative to the existing tariffs.

The time-varying rates were tested with and without enabling technologies. Three types of technologies were considered: in-home displays, the Energy Orb and a switch to cycle the CAC compressor during critical peak hours. Ten critical peak days were called between the months of June and August.

Unlike most other pilots, the PWEP included both residential and small commercial and industrial customers. A total of 2,200 customers were included in the experiment, equally divided between the residential and small commercial and industrial (C&I) classes.

We used the constant elasticity of substitution (CES) model to estimate customer sensitivities to time-varying prices and used the model to predict impacts on peak demand during the critical periods under a variety of critical peak prices.

We found that the elasticities of substitution, while smaller than those observed in warmer climates, are statistically significant and that impacts on peak demand are perceptible.

Surprisingly, we also find that equivalently designed PTR and CPP rates do not have equivalent impacts on peak demand. This finding contradicts the result found in the BOE pilot which ran during the summer of 2008 in Maryland and is in line with the PowerCents DC pilot carried out by Pepco in the District of Columbia which also ran during the summer of 2008.

In terms of peak demand impacts, we find that for the residential class, they range from 1.6 to 23.3 percent, depending on the type of rate design and enabling technology. These lines are generally in line with findings from other pilots with similar rate structures.

For small C&I customers, peak demand impacts range from 1.7 to 7.2 percent. TOU rates in both classes had the smallest impacts, possibly because the peak period was eight hours long.

The Energy Orb did not boost price responsiveness, again in contrast to results observed in Maryland. However, the CAC compressor cycling switch boosted responsiveness for dynamic pricing rates but not for the TOU rates.

A Fuel Without a Voice

Cliff Rochlin
Southern California Gas Company
Abstract for CRRI 23rd Annual Western Conference

IHSCERA (Cambridge Energy Research) has characterized the natural gas industry as a 'Fuel Without a Voice.' That is, the natural gas industry is a policy taker; not a policy shaper. For example, in the recently passed US House of Representative Waxman-Markey cap-and-trade energy bill, natural gas is scarcely mentioned and the California Air Resources Board Concept paper for a 33% Renewable Energy Standard specifically excludes natural gas as a potential contributor to greenhouse gas (GHG) reductions. Clearly, natural gas' inherent advantages are not being recognized as part of the global warming solution. Instead, natural gas, as a hydrocarbon, has been grouped with oil and coal as a carbon emitter.

The natural gas industry can only rehabilitate its image by taking a more active role in shaping energy and greenhouse gas policies. The fundamental drivers for including natural gas as a viable fuel is its high efficiency in end-use applications, low carbon content compared to coal and oil, synergies with renewable resources, and a transition fuel to meet GHG goals. In addition to these attributes, the unexpected gas bubble, created by recession induced declining gas demand, the sudden surge in unconventional gas (shale) production, and the worldwide glut of liquefied natural gas (LNG), has led to a significant reduction in gas prices. As gas demand rebounds from recessionary lows, the expectation is that abundant gas supplies will contribute to keeping gas prices relatively low compared to oil prices and more stable than it has been in recent years. However, economic good news alone will not forge a greater role for natural gas. The natural gas industry needs a visible and coherent presence to take its seat at the energy table.

The paper will use California's experience with natural gas to document its limited role in the state's future energy policy and will explore how the economic realities of utilizing natural gas can create a sustainable, coherent, and cost-effective energy policy.

Regulation by Independent Commission: College or Hierarchy?

William E. Kovacic, Commissioner, U.S. Federal Trade Commission: wkovacic@ftc.gov

Abstract for CRRI June 2010 Western Conference

Many jurisdictions rely upon multimember commissions to regulate the conduct of specific economic sectors (e.g., telecommunications) or to execute broader regulatory functions (e.g., competition policy and consumer protection). In the United States, this is the dominant model employed at the national and state levels.

A central assumption supporting this choice of regulatory framework is that decision by a multimember college yields superior results than oversight by a body headed by a single individual. A variety of theoretical rationales support the choice of regulation by college versus regulation by hierarchy. A central reason is that collective decision making will provide a better discussion and examination of the merits of proposed agency initiatives than decisions taken by a single administrator. The superior results of collective decision making are said to stem from several sources, including the appointment of a wide range of relevant experts to the college and increased political legitimacy that flows from the selection of individuals with diverse political preferences.

This paper will consider the degree to which these conceptual rationales are reflected in actual practice. The paper will review the benefits and costs associated with regulation by a college and a hierarchy, respectively. It will draw upon the conceptual literature and the author's experiences of as a member of and, for a time, the chair of a federal regulatory commission.

The Portfolio Capacity Value of Wind, Solar, Energy Efficiency, and Demand Response

Robert Earle

Renewable portfolio standards have induced a large amount of wind and solar projects both planned and actual. At the same significant efforts on both the state and federal level in energy efficiency and demand response have resulted in planning and resource expenditure on these programs. In calculating which initiatives to fund for renewable, energy efficiency, and demand response a variety of screening applications are typically use that calculate amongst other factors the capacity value of the proposed program. Little attention is paid, however, to the portfolio effects of these programs together. Do they exhibit economies of scope or diseconomies of scope? For example, demand response has been bruited to help 'firm' wind power thus increasing its capacity value. This paper examines the degree to which wind, solar, energy efficiency, and demand response are complements or substitutes from the standpoint of capacity value.

Policy Risk and Private Investment in Ontario's Wind Power Sector

Guy Holburn
Associate Professor
Richard Ivey School of Business
University of Western Ontario
1151 Richmond Street North,
London, Ontario. N6A 3K7. Canada
Tel: (519) 661-4247
Email: gholburn@ivey.uwo.ca

Kerri Lui
Researcher
Faculty of Law
University of Toronto
84 Queen's Park
Toronto, Ontario. M5S 2C5. Canada
Tel: (416) 728-2306
Email: kerri.lui@utoronto.ca

Charles Morand
Researcher
Richard Ivey School of Business
University of Western Ontario
1151 Richmond Street North,
London, Ontario. N6A 3K7. Canada
Tel: (519) 488-5053
Email: cmorand.mba2008@ivey.ca

September 8, 2009

Policy Risk and Private Investment in Wind Power: Survey Evidence from Ontario

Abstract

We argue that even though governments may adopt favourable regulatory policies for renewable power generation, their ability to encourage private sector investment depends on the presence of regulatory governance institutions that provide credible long-term commitments to potential investors. A comprehensive public policy approach to renewable energy reform thus requires an integrated assessment of regulatory policies and regulatory governance regimes. In the case of Ontario we contend that, despite large market potential and comparatively strong regulatory incentive policies, weak regulatory governance is one factor that has accounted for the historic and current challenges in attracting and implementing large scale private investment in power generation at a reasonable cost. We find empirical support for our hypotheses in a unique survey of 63 wind power firms that assesses private sector opinions about the investment environment for renewable energy in Ontario.

Key words: renewable energy, wind power, regulation, policy stability, Canada

Modeling Wind & Load for Cost and Reliability Studies

Paul D. Nelson

Abstract

In the past, renewable resources such as wind were a very small part of the utility portfolio, so the modeling of their output was simplistic. The wind generation assumption was often deterministic shape which does not incorporate its true variability. With increasing amounts of intermittent generation to achieve 20-30 percent renewable goal, new modeling methods are needed. During period of higher temperature, therefore high loads, the output of wind declines which adds to the complexity of modeling the relationship between wind and load. The paper presents a statistical method to find the point at which when wind output declines during high loads. The next step is to incorporate this information with a stochastic approach for wind and load in the modeling. This methodology can be used for production cost modeling or planning reserve margin studies.

A Market-based Assessment of Universal Service Reform Requirements

By Victor Glass

Congress and the FCC are grappling with formulating a universal broadband strategy to accomplish two national objectives: to make access to broadband services universally available and to boost take rates for broadband services. Interested parties are trying to answer a host of critical questions related to these two objectives: How to define a minimum broadband speed? What mechanism will allow the minimum to adjust over time? What geographic areas should be funded? What should be the effects of competition on total support and geographic areas in need of support? How should support be linked to access reform? Who should receive the funds, landline and wireless networks, one or more networks? Should funding go to a carrier of last resort (COLR) only or should another definition hold? Should the funds received be based on regulated financials of consolidated company financials? Should the government fund networks or individuals? Should there be caps on the fund? Should universal service reform go beyond funding? For example, should rules changes require most-favored interconnection terms and conditions for a COLR with other facilities-based providers? Should a COLR have most-favored access to content to boost take rates and fund their networks? Should the government aid Americans without computer training and computers to boost take rates? On the funding side, how should the government assess users of the network, by connections or retail revenues? If funding is by connections or revenues, should they be retail ones or some type of value added standard? Can a retail connection be clearly defined in an all packet world? The objective of this paper is to show that a few key market drivers are critical to answering these questions such as the movement to carrier quality connection-oriented packet services as opposed to Internet-based services, the struggle to become the gateway into the customer's premises, and the expanding set of services carriers will offer using packet technology.

Sabotaging Innovation

by
David E. M. Sappington and Ying Tang

Sabotage by a vertically-integrated provider (VIP) is an important issue that has captured the attention of policymakers and academic researchers alike. Sabotage occurs when a VIP disadvantages a retail rival, either by raising the rival's operating cost or reducing the demand for the rival's product. For instance, a VIP might limit or delay the rival's access to its ubiquitous network and/or reduce the quality of the access.

Regulators in the telecommunications industry devote considerable resources to detecting and limiting the sabotage that incumbent VIPs might impose on rivals who require access to the VIPs' networks in order to serve retail customers. Academics have devoted considerable attention to identifying conditions under which sabotage is particularly likely or relatively unlikely to occur. The literature notes that cost-increasing sabotage often is profitable for a VIP because it allows the VIP to engage in retail competition against a weaker rival (i.e., a rival with higher production costs). In contrast, demand-reducing sabotage often is unprofitable for a VIP because the reduced consumer demand caused by the sabotage induces the rival to set a lower price for its retail product. The lower price reduces the VIP's profit, and so the VIP may optimally refrain from demand-reducing sabotage.

Our research demonstrates that a VIP may be more inclined to engage in demand-reducing sabotage when its retail rival can undertake cost-reducing research and development (R&D). By constricting the rival's equilibrium output, demand-reducing sabotage can limit the rival's gain from undertaking R&D that reduces its unit cost of production. Consequently, demand-reducing sabotage can secure a relative cost advantage for the VIP by curtailing the rival's cost-reducing R&D. The resulting sabotage can be so intense that the rival may enhance its profit by intentionally limiting the efficacy of its R&D activities. Thus, even when it is not exercised in equilibrium, sabotage can have a chilling effect on industry productivity.

A General Approach to Determining Right of Way Fees in Thin Markets

Gregory M. Duncan-*University of California, Berkeley and The Brattle Group*
Lisa J. Cameron-*The Brattle Group*

Abstract

We revisit a number of rights-of-way issues applying a consistent approach to determining the appropriate payment from the user to the owner. The correct outcome, we argue, makes the property owner indifferent between allowing the use of the property and forbidding it. The payment is the efficient components price proposed by Willig, Baumol and others for pricing bottleneck facilities.

We show that the method is equivalent to allowing the property owner to charge fair market value. In particular, when a sufficiently developed market exists for property, the rule will yield the fair market value. Its value becomes apparent when fair market value is difficult to determine, as in the case of pipelines crossing desert land within Native American reservations, or when abandoned rail right of way crosses undevelopable swamp land is reclaimed by previous owners who proceed to hold up another utility which co-occupied the space but by dint of the railroad's right not its own.

In particular, we show the payment compensates land owner its costs of providing access but does not allow the land owner to extract the value of the right of way to the user.

Additionally, using methods proposed by Salant for determining royalties, we show that the method is usually equivalent to Nash and Shapley value bargaining solutions to the same problem.

Integrating Renewables into Electricity Markets: The Need for Smart Regulation

by
Tim Mount*, Alberto Lamadrid, Surin Maneevijit, Bob Thomas and Ray Zimmerman
Cornell University

Abstract

The inherent variability of generation from renewable sources, such as wind and solar power, may 1) increase the operating costs of the conventional generators used to follow the net load not supplied from renewable sources (i.e. due to additional ramping costs), and 2) increase the amount of installed conventional generating capacity needed to maintain System Adequacy. Both of these factors impose additional costs on the system that should not be ignored by regulators. The higher operating costs for conventional generators are partly offset by lower wholesale prices, due to reducing the total annual generation from fossil fuels. However, the lower wholesale prices imply lower annual earnings for conventional generators that lead to higher amounts of "missing money" needed to maintain the Financial Adequacy of these generators. The important implication for regulators is that high penetrations of renewables will lower the wholesale price of energy ($/MWh), but at the same time, the corresponding price of installed generating capacity ($/MW) will be higher. Mitigating the variability of generation from renewable sources can be accomplished by installing storage capacity and/or controllable (disputable) loads such as pumping water. Potentially viable forms of storage include utility-scale batteries, compressed air, thermal storage, and the batteries in electric vehicles. The objective of this paper is to demonstrate how markets for electricity should be modified to provide the correct economic signals for compensating storage and controllable loads that reflect the true system costs/benefits of ramping services and reducing the capital cost of maintaining System Adequacy.

The Cornell SuperOPF is used to illustrate how the system costs can be determined for a reliable network (the amount of conventional generating capacity needed to maintain System Adequacy is determined endogenously). The proposed regulatory changes for electricity markets are 1) to establish a new market for ramping services, and 2) to aggregate the loads of customers on a distribution network so that they can be represented as a single wholesale customer on the bulk-power transmission network. These wholesale customers would pay real-time wholesale prices for energy and demand charges based on their aggregate loads when the system peak load occurs. The implication is that if regulators ensure that the correct economic incentives are given to market participants, the higher cost of capacity associated with renewables will lead to investment in new network capabilities that will make it feasible to manage the total system load more effectively. As a result, the variability of generation from renewable sources will be mitigated, and in addition, the system peak load on the bulk-power transmission network will be lower leading to reductions in the total capital cost of maintaining System Adequacy.

* Corresponding author, tdm2@cornell.edu.

Using Storage to Increase the Market Value of Wind Generation

Ramteen Sioshansi*
Integrated Systems Engineering Department, The Ohio State University, Columbus, Ohio, United States

Abstract

One economic disincentive to investing in wind generation is that the average market value of wind energy can be lower than that of other technologies. This is driven, in part, by the negative correlation between wind availability and loads and market imperfections. We examine the use of energy storage to mitigate this issue by shifting wind generation from periods with low prices to periods with higher prices. We show that storage can significantly increase the value of wind generation and show the sensitivity of this value to a number of parameters including storage device size, storage efficiency, and market competitiveness.
Key words: Wind generation, energy storage, electricity markets, imperfect competition.

A Feasibility Analysis of Limited Energy Storage for Regulation Service

Nichole Taheri and Robert Entriken

Limited energy storage (LES) is a possible addition to the electricity grid that would allow Regulation Service to be provided by sources outside regional transmission organizations or supplementary generators. LES devices would be charged before use by receiving surplus power from the grid and provide power by discharging when not in use. In this report, the feasibility and capability requirements of incorporating LES into the grid are analyzed. Using publicly available regulation data from PJM Interconnection LLC, the report establishes sample requirements. Finally, after the viable constraints of this integration are determined, the report suggests possible improvements to ensure that the system will be able to accommodate the transition.

REVISED May 28, 2010 as follows:

CRRI Abstract May 2010 – Art Altman

Electricity-Price Modeling: Gaps & Disruptions

Modelers using fundamental techniques to forecast electricity prices have been complaining that their forecasts underestimate actual observed prices. We will explore that situation, discuss likely causes, and suggest practical alternatives. We will also discuss recent upheavals in energy markets (e.g. gas price gyrations due to demand fluctuations and shale technology) and enumerate likely near term disruptions that will challenge the work of energy price forecasting.

Towards a Risk Analysis Framework for Extreme Weather Impacts on Electric Power Systems
Robert Entriken

This paper examines actions that electric utilities could undertake to help them increase their resilience to the impacts of extreme weather. These could include impacts on the supply of, and demand for, electricity. The paper assembles the latest knowledge about weather trends, weather impacts on power systems, and risk accounting and analysis for regional studies, and it is likely that the impacts of extreme weather events can be incorporated into exiting utility planning practices. The kinds of strategies applicable to extreme weather (reinforcements, pre-positioning, and recovery) may be part of existing decision processes or they can be layered on top. Perhaps the key to assessing the value of this risk framework is to consider how to incorporate the added scope of costs, benefits, and risks associated with extreme weather.

Risk Margins and Risk Measures:
Establishing Risk Informed Regulations and Performance Goals

Frank J. Rahn
Electric Power Research Institute
Palo Alto CA
and
Ian B. Wall
Consultant
Atherton, CA

During past 15 years, the regulation and operation of nuclear power plants within the United States has become increasingly risk-informed. The presentation provides some background on probabilistic risk assessment. It describes many existing risk-informed activities, which have contributed to large improvements in plant safety and performance. Quantitative costs and benefits of some of these activities will be discussed. Also discussed will be how risk-informing regulation improved both safety and operations as well as reducing costs.

This presentation will also describe a methodology for meeting pre-established management and regulatory goals for operating complex systems such as power plants, transmission systems and chemical facilities. It shows how instantaneous and cumulative risk results can be used to measure compliance with either management or regulatory goals. Real time measurements can be used to assess unacceptable performance, and provide guidance to system operators on how to restore risk margins. Cumulative risk results can be indicators of long term performance within prescribed (i.e., acceptable) operating ranges. An example is provided of a highly complex system of mutually interacting six generating units (including a nuclear power plant) and an electric transmission grid.

Developing Stochastic Optimal Power Flow Tool for Large Scale Power Systems

Taiyou Yong and Robert Entriken

This research is concerned with developing a STOPF tool for the large scale power systems. Computation efficiency is the biggest challenge of the STOPF when it applies to the large scale power system. The scenario space to cover the system randomness is huge if we consider the full uncertainties of system outage, intermittent generation and demand response. The industrial level of optimization solvers like CPLEX, MINOS and DECIS are able to solve the large scale problem efficiently. It makes it possible to implement the STOPF for the large scale power systems.
This report presents how to implement the STOPF and SCOPF with the modeling language-GAMS and solve the STOPF for the large scale power systems. The detailed implementation is illustrated in a 9-bus system. The PJM system that has more 10000 buses, 2500 generators and about 20000 transmission branches is used to demonstrate the STOPF tool implemented in GAMS and DECIS can solve the STOPF problem for the practical power systems.

Udi Helman*, Clyde Loutan, Grant Rosenblum, Barney Speckman, "Operational and Market Simulation of alternative 33% RPS portfolios in California"

California has recently taken significant steps towards a 33% Renewable Portfolio Standard (RPS) by 2020, the highest such standard of any state in the US. Although not supported yet by state legislation, this standard has been required by executive order of the governor and incorporated into the state's greenhouse gas implementation strategy. This study provides the first public analysis to examine the likely operational and market impacts of such an RPS. Five alternative RPS portfolios are studied, mixing different levels of large-scale wind and solar facilities, both in-state and out-of-state, and distributed solar PV. Each portfolio is also subject to sensitivities to different levels of load-side greenhouse gas reduction measures, such as end-use energy efficiency as well as the impact on load shapes of electric vehicle penetration. The study methodology employs some novel approaches to estimating production profiles from wind and solar technologies by renewable energy zone, calculates expected changes in ancillary service requirements and overall system ramp rates using a Monte Carlo simulation method that replicates the actual sequence of hourly and subhourly wholesale market and operational procedures, and then uses a detailed production simulation of the California and western power system to examine costs of integration, operational impacts such as overgeneration, and the possible need for additional thermal generation to provide integration capabilities.

*Corresponding author. Principal, Markets and Infrastructure Division, California Independent System Operator, Folsom, CA 95630

[Note: this project has multiple contributors, some of which may be added to the author list]

Rutgers Center for Research on Regulated Industries
Western Conference Summer 2010
ABSTRACT

Modeling Approach and Stakeholder Process: Earning Consent for Aggressive GHG and Renewable Energy Goals in the West

Richard McCann, Carl Linvill and John Candelaria, Aspen Environmental Group
Dec. 1, 2009

Fundamental changes in the economy and technology, aggressive policy initiatives and the emergence of a credibility deficit have moved Western electricity system planning activities to a point where the consent of stakeholders must be earned for all new transmission projects. A necessary condition for earning consent is that the modeling process and platform enable a transparent stakeholder process that is informed by a robust exploratory modeling exercise. Case studies of planning exercises since the western energy crisis indicate an evolution in transparency and stakeholder process. New planning exercises in California and the Western Interconnection have the opportunity to further that evolution. The missing link to date has been a modeling platform that facilitates full stakeholder vetting for a wide range of futures and a wide range of model relationships. While the model platform may be limited to align with the range of policy questions that will be considered in the stakeholder process, the model should be comprehensive and flexible to demonstrate results for a wide range of futures. A robust stakeholder process thus requires an exploratory modeling approach.

Implementing an exploratory modeling approach requires a scenario generator (a platform model against which all futures and relationship changes are tested) that is up to the task. While there have been improvements in modeling platforms over the decade, the platforms constructed to date are not yet ready to serve as a scenario generator platform for an exploratory modeling process. The purpose of this paper is to evaluate several existing and proposed modeling platforms in the west for their potential aptitude as an exploratory scenario generator. The paper defines a set of scenario generator evaluation criteria and then grades competing platforms on their exploratory modeling aptitude.

Bringing Prices to Devices under Smart Grid: Challenges and Opportunities

By
Farrokh A. Rahimi, Ph.D., Ali Ipakchi, Ph.D., Farrokh Albuyeh, Ph.D.
Open Access Technology International, Inc. (OATI)

Abstract: The Smart Grid movement brings challenges and opportunities for both the electricity providers and the electricity consumers. Under Smart Grid, three classes of resources, namely Demand Response, Distributed Generation, and Storage, will have a prominent role in shaping the face of the electricity industry, primarily at the distribution/retail level, but also at the wholesale energy market level. The "devices" comprising these resources may respond to market signals directly based on market prices, or indirectly based on "dispatch" instructions from relevant system operators based on prior contractual arrangements between device owners (retail customers) and their counterparties (Distribution Companies, Load Serving Entities, Curtailment Service Providers, etc.). In either case, a central issue is how to translate economic signals or instructions from a market operator (ISO/RTO) to economically efficient signals or instructions to individual devices (or an aggregate of individual devices).

Market operators generally compute and publish price signals (Locational Marginal Prices-LMPs) at plant or at transmission/sub-transmission substation levels modeled in their network model used for market clearing, congestion management, and pricing. Translating these market prices to prices at device levels would require the consideration of congestion and losses at the distribution grid level.

Other related issues are, the provisions and restrictions on participation of such devices (or aggregates) in the market, as dictated by relevant local and federal regulatory entities. For example, whether or not feed-in tariffs prevail, may impact the approach for consideration of distribution congestion and losses in computing device level prices.

A related issue is whether such local prices should be applied only when such devices act as supply or pseudo-supply (Negawatts), or to both supply and consumption of the end-use consumer.

This paper will explore the possibilities and impediments in "bringing prices to devices" from technical, operational, and regulatory points of view.

Index Terms: Ancillary services market, congestion management, Curtailment Service Provider, Demand Response, DER, Distributed Energy Resources, Distribution, DR, Energy Markets, Feed-in tariff, ISO, LMP, Location Marginal Price, Market clearing, Market prices, Negawatts, PEV, PHEV, Plug-in Hybrid Electric Vehicles, RTO, Smart Grid, Variables resources

Topic: Elimination of barrier to participation by demand resources in organized wholesale electric markets

Abstract: The FERC Strategic Plan calls for the identification and elimination of barriers to participation by demand resources in organized wholesale electric markets. To further this objective, FERC staff has been meeting with a variety of stakeholders. This paper will describe the major findings of staff, discuss potential solutions and the process of changing practices in order to facilitate the efficient development of these resources.

Tatyana Kramskaya
Energy Industry Analyst
Office of Energy Policy and Innovations
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426
Tel. (202) 502-6262
Fax (202) 219 - 1274
E-mail: Tatyana.Kramskaya@ferc.gov

Paper to be presented by David Hunger, U.S. Federal Energy Regulatory Commission

Draft Abstract of Paper to be Presented at the C.R.R.I. Western Conference in June 2010 – Paper to be co-presented by
David Yates and Matt Pocernich of NCAR
Co- Presenter - Richard Aslin of PG&E

Stationarity is Dead – A practical solution for utility scale planning models that depend on long-term climate projections

With increasing awareness of the very strong likelihood and magnitude of climate change, the assumption of stationarity is no longer (if it ever was) justifiable. A recent article in Science Magazine states "In view of the magnitude and ubiquity of the hydro-climatic change apparently now underway, we assert that stationarity is dead and should no longer serve as a central default assumption in water-resources risk assessment and planning. Finding a suitable successor is crucial for human adaptation to changing climate" (Milly et al, 2008). The lack of stationarity affects estimates used in a variety of climate and weather related statistical calculations. These include wind speeds used to set building standards, the frequency and intensity of storms used to plan hydrological structures or delineate flood zones, the possible frequency and duration of droughts in agricultural and electric resource planning, and the frequency, duration and intensity of hot weather periods which affect planning for electric infrastructure and public safety.

The purpose of the research presented below is to provide a possible solution for some applications to the lack of stationarity in climate data. The solution presented provides a possible means for utilities, regional planners and regulators to incorporate climate change assumptions into their long-term demand forecasting models is a way that is both defensible and cost effective.

The Integration of Plug-in Hybrid Electric Vehicles (PHEVs) for Wind Balance

Robert Entriken and Marcus Alexander

This paper is a survey of models and techniques for assessing the integration of limited storage devices, like PHEVs, to facilitate renewable wind resources. It includes results of decision models and national planning studies in the US. The report concludes by describing a framework for future research in this area.

Abstract for CRRI Conference, June 23-25, 2010

Robert Levin, Division of Ratepayer Advocates, California Public Utilities Commission, 505 Van Ness Avenue, San Francisco, CA 94102

November 25, 2009

Electric Vehicles: A Ratepayer Perspective

There is near-universal agreement that electrification of personal transportation is among the most promising avenues for reducing greenhouse gas emissions. Numerous other potential benefits of EVs have been noted. In response to several automobile manufacturers' announcements of forthcoming electric vehicle (EV) releases, in 2009 the California Public Utilities Commission (CPUC) initiated a rulemaking addressing developing markets for EVs and other alternate fuel vehicles. Thus far, about 20 parties have submitted comments as requested by the CPUC, addressing such issues as infrastructure requirements, costs, and who should pay, among many other issues.

Many parties, including most of California's major electric utilities, suggested the need for major near-term investments in electric distribution infrastructure to prepare for and/or facilitate EV market development. This paper examines costs and benefits of EV-related infrastructure investments, as well as equity and rate design issues raised by parties' proposals, from a residential ratepayer perspective. Five categories of potential utility investments are discussed, including public EV charging stations, in-home EV charging infrastructure; residential metering and submetering; local utility distribution grid upgrades; and EV-related research and customer outreach.

Such investments could be in the public interest, however, the need for such investments in the near-term depends on EV sales volume and the mix of battery-only vs. plug-in hybrid vehicles sold. Additionally, some parties have pointed out that sales of EVs are likely to cluster in affluent residential areas, raising equity issues if EV-related infrastructure costs are to be spread to all ratepayers. Given the evident uncertainties as to the number and mix of EVs sold over the next half-decade, a measured approach to EV-related utility investments, with careful attention to rate design and equity issues, is recommended.

Beyond Emissions: The Utility Shareholder and Ratepayer Benefits of Plug-in Hybrid and Electric Vehicles.

Paper Proposal for
Advanced Workshop in Regulation and Competition
2010 Annual Western Conference

Author

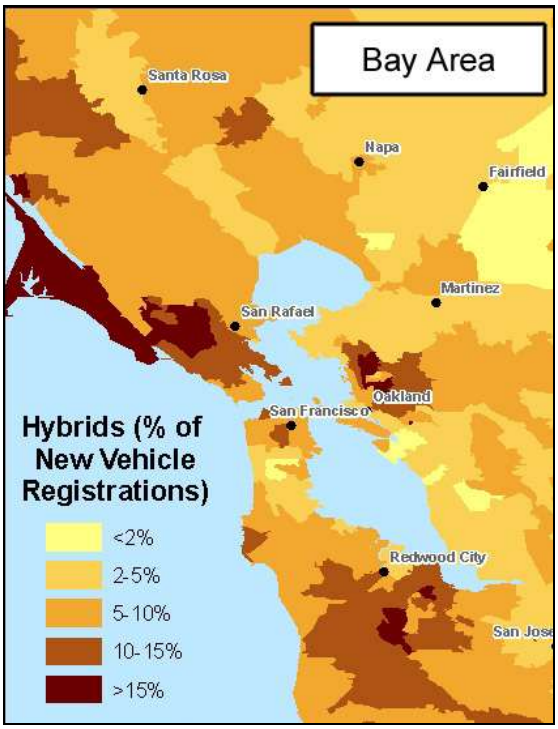
Eric Cutter
Energy and Environmental Economics
101 Montgomery Street, Suite 1600
San Francisco, CA 94104
W (415) 391-5100
eric@ethree.com

Abstract

PHEV load growth may be coming sooner than you think driven by factors beyond the utility's control, with big challenges for peak capacity and distribution planning. Nevertheless, PHEV loads should be viewed as a positive fuel switching program with net economic and environmental benefits for the utility, its ratepayers and society. Based on prior work with west coast utilities, this paper summarizes the work performed by the Freeman, Sullivan and Co. (FSC) and Energy and Environmental Economics (E3) to develop a PHEV strategy and gain regulatory approval for a smart charging program. FSC developed detailed forecasts of PHEV adoption using automotive industry, customer survey and demographic data. E3 developed a detailed charging profile and revenue requirements model to estimate resource costs, quantify utility, societal and ratepayer impacts and provide utility financial metrics.

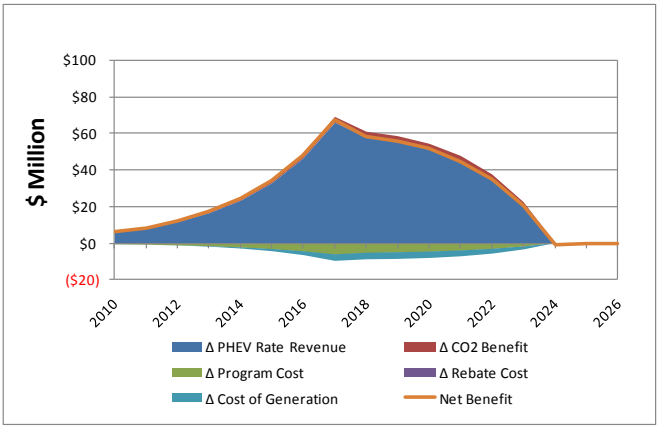
PHEV loads reduce fossil fuel use and GHG emissions and are essential to meeting long term climate change goals. PHEVs can also use excess, off-peak wind generation, facilitating the integration of renewable resources. Furthermore, unlike any other initiative, a PHEV program can simultaneously reduce rates and increase earnings. But, these benefits can only be realized with a smart charging program, which will take several years to implement and need to overcome internal and external resistance. A PHEV smart charging initiative will require a coordinated effort at the utility management level because most departments, including generation planning & procurement, distribution planning, energy efficiency, billing and information technology will see challenges that outweigh the benefits. A high level regulatory strategy is also essential to navigate efficiency, RPS and GHG policies that

Concentration of PHEV Adoption Will Place Strain the Distribution System



HEV adoption information is extremely valuable because it informs planners where potential distribution problems are likely to arise. An FSC study of HEV adoption in California showed that while the vast majority of area experienced less than 5 percent market share for HEVs, certain areas along the coast experienced greater than 15 percent market share. In a populous zip code in the Bay Area, 599 out of 2596 (23 percent) new vehicle registrations were HEVs.

Accelerated PHEV Adoption Can Provide Net Ratepayer Benefits



A detailed revenue requirements model developed by E3 calculates the net utility, ratepayer and societal benefits of increased PHEV adoptions under different scenarios. In the figure presented here, a rate and smart charging program implemented by a hypothetical utility increases revenues by more than the incremental infrastructure and generation costs with net benefits to ratepayers.

Paper Title: California's New Electricity Market:
Overview of First Year of Performance and Recommendations Moving Forward

Nelson, Jeffrey

Presented by Willy Wang

On March 31, 2009, California launched the long awaited overhaul of its electricity markets. Known as the Market Redesign and Technology Upgrade (MRTU), California now produces some 3,500 locational marginal prices energy prices every 5 minutes, as well as hourly day-ahead prices for energy, ancillary services and capacity. While by most metrics the market has performed well, it nevertheless has not been free of growing pains. This paper provides a survey of the first nine months of market performance. It discusses overall market price results, as well as issues including out-of-market dispatch, administrative impacts on prices, Hour Ahead Scheduling Process (HASP), Residual Unit Commitment (RUC) and real-time market performance and price formation. Several planed market enhancements and their anticipated impact are discussed. Recommendations to improve market efficiency are provided. Finally, based on certain observations on the shortcomings of decomposing LMP into only three components (energy, losses and congestion) in the presence of uplift costs, local capacity, local energy and nomogram constraints, recommendations are provided that could have policy implications for all LMP markets.

Optimal Transmission Switching: Economic Efficiency and Market Implications

Kory Hedman[1], Shmuel Oren[1], and Richard O'Neill[2]
[1] University of California at Berkeley, [2] Federal Energy Regulatory Commission

Traditional security constrained economic dispatch of electricity resources treats the transmission network as a fixed static topology while optimizing deployment of generation assets. However, it is well known that the redundancy build into the grid in order to handle the multitude of contingencies over a long planning horizon can, in the short run, create congestion and necessitate costly out of merit dispatch. While it is quite common for operators to occasionally open lines that reach their thermal limit, such practices are employed on an ad hoc basis and are not driven by cost considerations. However, as we move toward a 'Smart Grid' and advanced fast switching technologies become prevalent it is reasonable to consider a new dispatch paradigm that treats the grid topology as flexible and subject to reconfiguration in the same time frame as output adjustments of generation resources. In this paper we explore, from an economic perspective, the potential of treating the grid as a flexible topology that can be co-optimized along with generation dispatch, subject to reliability constraints, so as to minimize the cost of serving load. We then examine the implications of such co-optimization by the system operator on locational marginal prices (LMP) used to settle energy transactions and on the financial transmission rights (FTR) market which is common in the US as a mechanism that enables market participants to hedge their congestion risk.

The paper will first review recent work by the authors demonstrating that optimizing the network topology with generation unit commitment and dispatch can significantly improve the economic operations while maintaining the traditional "N-1 reliability" standard. Our analysis also provides an assessment of potential economic gains from smart grid technologies that will enable replacement of the N-1 reliability standard in favor of new reliability concepts such as "just in time N-1 reliability". Test results based on a DC OPF analysis are presented for the IEEE 118 bus model, the IEEE RTS 96 system, and the ISO-NE 5000 bus electric grid with all showing significant efficiency improvements in economic dispatch through transmission switching.

Unfortunately, modifying the transmission topology for the common good interferes with some of the underlying assumptions that facilitate financial transmission rights markets. While such topology optimization will increase social welfare, it has unpredictable impacts on locational marginal prices (LMPs), congestion rents, and payments to FTR holders. Depending on the initial allocation of the FTRs, transmission switching may create winners and losers among FTR holders and result in revenue shortfall for the ISO, i.e. the congestion revenues may not cover the FTR settlements. We demonstrate such phenomena through simple illustrative examples and more elaborate market simulations and discuss potential remedies.

Abstract

Economists Play With Blocks:

The Challenges of Designing Markets for the Electricity Industry

submitted December 4, 20089 by Kevin Woodruff
Principal, Woodruff Expert Services
to Center for Research in Regulated Industries
for consideration for at 23rd Annual Western Conference, June 2010

One of the challenges electric industry policy-makers have faced over the last three decades has been implementing "markets" where none had existed before. This effort was central to the theory of industry reform, as markets were believed to offer the solution to the inefficiencies of the vertically-integrated utility model. This task was also critical to industry reform in practical political terms, so that the results of reform would be acceptable to the general public.

This paper will review these hopes, the challenges to achieving such hopes, and certain "market design" issues and efforts the author has witnessed over time. The review will cover in particular the impact of parties' real-world interests on such design efforts, and the role of professional economists in promoting particular designs. The paper will finish with some of the author's conclusions about what policy-makers should expect when faced with "designing" electric markets.

Abstract Submission for the 2010 Western Conference

CRRI, Rutgers University

Rational Expectations and the Conservation-Oriented Pricing of Utility Services

Revised Abstract

Carl Danner

LECG

Abstract: To obtain realistic longer-term price signals, customers of regulated services like water and energy may look at trends in the utility bills they pay – rather than just at the rate schedule at any given time. A combination of rate-of-return regulation and prices not based on marginal cost (as in many conservation-oriented rate designs) can create feedback effects that make actual utility bills change differently than the rate schedule would have implied.

For example, a customer may see a high usage price and reduce consumption in response. However, if most customers do the same, then the utility will fail to cover its fixed costs and be forced to raise prices to make up the difference – thus eroding most of the bill savings the customer thought he would see. If all customers cut usage, then bills may fall only by the marginal cost savings from less commodity usage. This effect can undermine conservation incentives regulators attempt to create by setting usage prices well above marginal cost levels.

Shifts in contribution recovery among different groups of customers (as regulators might require for policy or political reasons) can also affect longer-term incentives. Customers may use less of the commodity but see bills increase because regulators have shifted onto them the responsibility to pay for the lost margin formerly paid by other, more politically favored customers. Whether customers see stated usage prices as a credible may in part depend on such feedback effects, and on perceptions of the political stability of regulatory rate-setting.

Proposed Paper for CRRI 23rd Annual Western Conference, June 23-25, 2010

Author: Stephen St Marie
Position: Policy and Planning Advisor
and Chief of Staff to Commissioner John A Bohn
Affiliation: California Public Utilities Commission

Contact: 505 Van Ness Avenue, Room 5201
San Francisco, CA 94102
415-703-5173
415-703-2532 (fax)
sst@cpuc.ca.gov

Title: Effects of High Tiered Rates on the Financial Stability of Regulated Utilities and Necessary Regulatory Response, with Application to Water Utilities

Abstract: Recommended practice for pricing regulated services of water utilities, as well as the services of some other utilities is to use inclining blocks, also known as "tiered rates." Tiered rates raise the price of the marginal unit of service for the purpose of sending the customer a "better" price signal. The high-tier price provides a strong signal to customers to limit consumption and a financial reward for doing so. There may be many reasons why the policy maker is in favor of higher marginal prices and lower consumption than would be achieved by simple average-cost pricing.

However, the consumer is not the only one who receives a strong price signal from the high-tier price. The utility company also is affected. While the price-setting policy maker may be pleased with the conservation effect on customers, the effects on the utility may be more problematic. The paper will discuss briefly several effects on the utility. One effect will be discussed at length: the effect on the financial stability of the firm.

Since sales quantities cannot be perfectly forecast, there is always some financial risk associated with deviation of sales from forecast. The greater the divergence between marginal rates and variable costs, the greater the financial risk associated with expected deviation from forecast sales.

This paper will discuss how the regulator can respond to reduce financial risk, primarily through decoupling revenue from sales. The paper will also discuss the degree to which decoupling may affect other aspects of utility financial risk and performance, raising the question of whether decoupling can return the utility's financial risk profile to the *status quo ante*.

Data from California water utilities, which have recently seen the installation of tiered rates and decoupling, will illustrate the discussion.

What Events and Policy Have Done to the Cost of Capital – and What They May Do in the Future – *Abstract for Paper Proposal for CRRI's 23rd Annual Western Conference, 23-25 June 2010, Monterey CA*

By Ron Knecht

The cost of capital (COC) indicated by the standard models used in utility regulation has exhibited severe dislocations during the financial blow up and Great Recession of the last two years. COC also was subject to identifiable trends in the prior decade. These dislocations and trends are linked mainly to dislocations and variations in the values of the four macro-economic variables that -- along with a firm's stock prices and dividends (or earnings for the ER model) -- determine the COC, according to the models. The four macro-economic variables, which are closely related, are the expected values for: the riskless rate of interest; the real growth rate for the overall economy; the inflation rate (which, together with the real growth rate, determines the nominal growth rate of the economy); and the equity market risk premium. I argue that the dislocations and variations in the expected values of these four variables in recent years can be connected to particular public policies and to trends that have been both endogenous and exogenous to those policies. Further, the shifts in some policies and unsustainability of some policies, and the macro-economic trends resulting in major part from them, led to a breakdown in the traditional ways of calibrating the standard models during the last two years that rendered their results unreliable for regulatory purposes. So, first, I offer some adjustments in the manner in which the expected values of the basic macro-economic variables are estimated to yield model results and COC estimates that are more reasonable for regulatory purposes. Second, in light of policy responses to the financial blow up and Great Recession and some policy.

Abstract Submission for the Rutgers 23rd Annual Western Regulatory Economics Conference (2010)

Topic: Combined Heat and Power in California

Author: Michael Colvin, Policy Analyst, Policy and Planning Division, California Public Utilitiies Commission.

Contact Information: 415-355-5484; mc3@cpuc.ca.gov

Paper Abstract:

California has adopted an aggressive set of policies to reduce greenhouse (GHG) emissions over the period 2012-2020, with the objective of reducing GHG emissions to 1990 levels by 2020. In October 2008, the California Public Utilities Commission and the Energy Commission issued a joint set of recommendations to the Air Resources Board, outlining strategies to reduce GHG emissions in the electricity sector. In December 2008, the ARB released its Scoping Plan to reduce GHG in the economy-wide in California.

The Scoping Plan lists Combined Heat and Power (CHP), also known as cogeneration, as the third largest reduction measure of GHG from the electricity sector in the Scoping Plan. Instead of the stand-alone production heat/steam (or other host customer thermal requirements) and electricity from the grid, a CHP facility produces both from one fuel source. When done correctly, less gas is combusted and fewer GHG are emitted.

Combined Heat and Power is also a substantial generation source of the California grid. As such, CHP is also a large emitter of GHG. CHP plays a unique role in the regulatory framework since it is both an emissions reductions strategy and an emitter of GHG. This paper will examine that relationship, including discussing the state's current CHP fleet in aggregate.

Since most CHP facilities are customer-owned facilities, the decision making process is different for these facilities when compared to traditional power plants. The paper will discuss how proper regulatory treatment is necessary to prevent disincentives for CHP, since facility owners respond to regulatory and financial signals differently than other parts of the nascent carbon-controlled system. Discussion will include potential ways to integrate the value of GHG (both emissions and avoided emissions) into CHP payments and how the avoided cost may no longer be the appropriate mechanism to do so.

Abstract Submission for the Rutgers 23rd Annual Western Regulatory Economics Conference (2010)

Topic: Cogeneration Facility Greenhouse Gas Reduction Potential

Author: Carl Silsbee, Manager of Resource Policy and Economics, Southern California Edison Company
Contact Information: 626-302-1708, carl.silsbee@sce.com

Paper Abstract:
Reduction of greenhouse gas (GHG) emissions has become a preeminent environmental issue in recent years due to concerns regarding the impact of higher levels of atmospheric GHG on worldwide climate. California has adopted an aggressive program to reduce GHG emissions over the period 2012-2020, with the objective of reducing GHG emissions to 1990 levels by 2020. California's governor has endorsed further reductions of 80% of 1990 levels over the period 2021-2050.

Cogeneration (also known as combined heat and power or CHP) is often suggested as a technology that can reduce GHG emissions and contribute to GHG compliance targets. Instead of the stand-alone production of electricity and industrial or commercial process heat/steam (or other host customer thermal requirements), a cogeneration facility produces both as joint products. A suitably designed cogeneration system can reduce GHG emissions relative to the benchmark performance of stand-alone electricity and process heat.

The author derives the engineering-economic relationships for cogeneration performance that result in GHG emission reductions (and natural gas fuel savings) relative to performance benchmarks, and suggests appropriate cogeneration standards to achieve GHG emission reductions in both the near term (through 2020) and longer term (beyond 2020). Finally, the author plans to explore the economic justification for subsidizing cogeneration facilities under regulatory regimes in which GHG emissions are an unpriced externality.

ABSTRACT: Advanced Workshop 2010 Eastern and Western Conferences

A Closer Look at the Connection between Natural Gas Demand and CO_2 Allowance Prices

Catherine M. Elder, Senior Associate Aspen Environmental Group

Lost in the fanfare of studies projecting energy sector impacts expected from implementation of cap and trade to regulate carbon dioxide (CO_2) emissions is a thorough discussion of the relationship between the various assumptions and the impact they have on the results. The study conclusions make headlines, with some saying U.S. utilities will burn more natural gas and some saying they will not.

A closer look at the assumptions used in each study is telling. Also telling are the resulting estimates of CO_2 allowance prices and how they relate to the assumptions and resulting natural gas use. Theoretically, allowance prices should equilibrate to the marginal source of carbon abatement, but that marginal source changes as other assumptions around the electricity resource mix change. Studies, for example, projecting low carbon allowance prices likely include show high use of offsets, nuclear generation, and generally lower energy demand. Higher natural gas prices make it harder for gas to displace coal in the resource mix without high carbon allowance prices. Thus, low carbon allowance prices theoretically imply relatively low natural gas prices. Another key turns out to be the assume availability or non-availability of carbon-capture and sequestration (CCS). CCS retrofits to exiting coal-fired units allow utilities to achieve carbon compliance while still relying on coal and the lower the assumed CCS cost the lower the allowance price.

This study will disentangle these relationships with a compare and contrast of four key studies done to evaluate the impacts of pending cap and trade legislation. These include: i) "*Energy Market and Economic Impacts of S. 2191*," released April 2008 by the U.S. Energy Information Administration; ii) "*EPA Analysis of the Lieberman-Warner Climate Security Act of 2008*" by the U.S. Environmental Protection Agency's Office of Atmospheric Programs; iii) "*The Power to Reduce CO_2 Emissions"* prepared in 2007 by the Electric Power Research Institute; and iv) "*The Influence of Technology and a Carbon Cap on Natural Gas Markets"* from Duke University's Climate Change Policy Partnership.

ABSTRACT

Does a Smart Grid Require Smarter Regulation?

Andrew G. Campbell
Senior Energy Advisor to Commissioner Rachelle Chong
California Public Utilities Commission

The electricity sector is being transformed by policies to reduce greenhouse gas emissions, increase renewable energy and distributed generation, and improve energy efficiency. Achieving these policy objectives, while maintaining reliability, will require a smarter electric grid that includes communications, sensors and controls. A Smart Grid can also improve efficiency and competition in power markets by enabling price-responsive demand and facilitating distributed energy resources.

Realizing a Smart Grid will involve entities that have not traditionally been active in the electricity sector including manufacturers of consumer products and end-users. However, even with a growing role for consumers and technology companies, the investor-owned utilities will play a central role in the development of a Smart Grid. This paper will explore, in the California context, whether the existing regulatory framework faced by utilities will lead to modernization of the electric grid or whether different regulatory approaches are needed. What challenges do traditional regulatory cost recovery processes present for Smart Grid investments that may have higher up front costs than traditional benefits but produce benefits over time? How important is dynamic pricing to engaging energy consumers? How will utilities respond to the decentralization of electricity supply and responsiveness of demand that accompany a Smart Grid? How can regulators support modernization of the grid in a manner that contains costs?

Policy Vision for the Smart Grid:

Performance Metrics and Incentives for Optimal Investment

23rd Annual Western Conference, Center for Research in Regulated Industries, Rutgers University,
Monterey, CA June 23-25, 2010

Dr. Eric C. Woychik
Black & Veatch Corporation
Email: WoychikEC@bv.com
Phone Number: 510-387-5220

Abstract: This paper presents a Smart Grid (SG) policy vision that aligns performance metrics and incentives for proper investment with customer value. SG investments, both from the meter to the generator and from the customer to the meter, are needed to optimize grid use and expand choice for customers. Primary SG objectives are to increased grid reliability and security, enable renewables, reduce-costs, and minimize the overall environmental footprint. Choosing from among SG options, including smart transmission and distribution (T&D), renewable, and customer choices, is very difficult. Traditional ratemaking heavily skews utilities to choose more profitable capital-intensive (rate-base) options in lieu of options that are expensed. This regulatory policy is the root of market failure that eliminates the use of certain resources (e.g., cost-effective software optimization) in favor of *iron-in-the-ground* options. The new world of SG investments requires complex value and cost calculations, use of environmental rules, and interpretation of renewable mandates. Of course SG profitability, cash-flow, and financing cannot be ignored. SG T&D resources enable renewables and offer a host of benefits but require detailed analysis to calibrate expected operations. At times, SG choices based on least-cost are at odds with choices based on lowest life-cycle costs. Some may initially seek least-cost but this may result in lost opportunities (e.g., from system downsizing based on superior volt/var control). SG customer options can provide choice of electricity consumption based on willingness to pay. To implement an end-to-end SG vision new policy and investment incentives must be harmonized with benefit-based metrics that net best choices for customers. Concurrently, resource providers need proper incentives to invest in the SG. A central principle of resource investment is that customer value does not exceed total costs. Hence, more effective alignment of investment needs and policy is needed. New holistic, cross-functional solutions are suggested. A proposed framework and an agenda for industry-wide dialog are proposed to realize this vision, particularly to resolve performance metrics, incentives, and the value propositions to be offered.

Abstract for CRRI Western Conference – 2010

Title: Smart Grid – a Transaction Cost Economics Review of Alternative Market Structures

Submitted by: Robert Robinson, Charles River and Associates
(rrobinson@crai.com)

Abstract:

The proposed research is intended to provide insights to market participants and regulators on the benefits/pitfalls of different market structures from a transaction cost perspective in the emerging markets.

This paper would apply a "science of contract" approach to analyze emerging issues in the US electric industry.

Specifically, the paper will apply the theories and applications of Oliver Williamson, winner of the 2009 Nobel price in Economics, to emerging issues in the electric industry, such as Smart Grid. The paper will summarize the primary tenets discussed by Williamson, such as transaction cost economics and the role of asset specific investment. The insights from this line of economic reasoning will then be applied to the market organization challenges facing the electric industry. For example, where control of various assets and decisions should be maintained is an emerging issue facing regulators and market participants developing a Smart Grid and there will be significant asset specific investment required to implement a Smart Grid.

This type of analysis was conducted during the early days of electric restructuring and has also been applied in numerous other industries. Williamson's "science of contract" review can provide an alternative perspective to traditional "science of choice" review. For example, Williamson discusses why vertical integration can be a rational and efficient way to organize in order to provide a new service, whereas a more traditional economic review might focus on anticompetitive or market power concerns only.

Abstract for the 2010 CRRI Western Conference

Title: On the Right to Submit Emissions Offsets When Regulators Impose Binding Quantitative Limits

The California Air Resources Board (CARB) is charged with implementing California's Global Warming Solutions Act (AB 32). As a design element of the cap-and-trade program, CARB plans to restrict the eligibility of emissions offsets for compliance to 49% of the mandated emission reductions, approximately 4% of each regulated entity's compliance obligation. A market for indirect emission reductions without such binding quantitative limits would be marked by an equilibrium price equal to the cost of direct emission reductions. At the equilibrium, regulated entities would be indifferent between direct emission reductions, emission offsets and holding emission allowances. Such an offsets market would result in only those offsets that could be produced at or below the market clearing price and there would be no unmet (excess) demand for offsets.

However, given a binding quantitative limit, the offsets market cannot clear in the traditional sense. Depending on the mechanism that the regulators use to distribute the right to own a compliance grade offset, project developers may engage in rent seeking behavior in order to have their projects approved by regulators, regulated parties may compete and bid offset prices well above the marginal cost of reductions, or third parties may intercede to clear the market. The method by which such a market clears is the subject of this paper.

The paper will review the current status of the offsets discussion in California and the Western Climate Initiative (WCI) region, and will evaluate the various means by which such a restricted market may clear.

Frank Harris, PhD
Manager – Global Climate Policy
Southern California Edison
949-812-8823
frank.harris@sce.com

The Influence of a CO_2 Pricing Scheme on Distributed Energy Resources in California's Commercial Buildings

Michael Stadler, Chris Marnay, Judy Lai, Gonçalo Cardoso, Olivier Mégel, and Afzal Siddiqui

The Ernest Orlando Lawrence Berkeley National Laboratory (LBNL) is working with the California Energy Commission (CEC) to determine the potential role of commercial-sector distributed energy resources (DER) with combined heat and power (CHP) in greenhouse gas emissions (GHG) reductions. Historically, relatively little attention has been paid to the potential of medium-sized commercial buildings with peak electric loads ranging from 100 kW to 5 MW. We examine how these medium-sized commercial buildings might implement DER and CHP. The buildings are able to adopt and operate various technologies, e.g., PV, on-site thermal generation, heat exchangers, solar thermal collectors, absorption chillers, batteries and thermal storage systems.

We apply the Distributed Energy Resources Customer Adoption Model (DER-CAM), which is a mixed-integer linear program (MILP) that minimizes a site's annual energy costs and/or CO_2 emission. Using 138 representative mid-sized commercial sites in California, existing tariffs of major utilities, and expected performance data of available technologies in 2020, we find the GHG reduction potential for these buildings. We compare different policy instruments, e.g., a CO_2 pricing scheme or an investment subsidy, and show their contributions to the California Air Resources Board (CARB) goals of additional 4 GW CHP capacities and 6.7 Mt/a GHG reduction in California by 2020. By applying different price levels for CO_2, we find that there is competition between fuel cells and PV/solar thermal. It is found that the PV/solar thermal adoption increases rapidly, but shows a saturation at high CO_2 prices, partly due to limited space for PV and solar thermal. Additionally, we find that large office buildings are good hosts for CHP in general. However, most interesting is the fact that fossil-based CHP adoption also increases with increasing CO_2.prices. We will show service territory specific results since the attractiveness of DER varies widely by climate zone and service territory.